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Infant shy temperament predicts preschoolers Theory of Mind

Daniela Mink*, Anne Henning, Gisa Aschersleben

Saarland University, Germany

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ABSTRACT

The aim of this longitudinal study was to investigate the relation between infant temperament at 18 months and early Theory of Mind (ToM) abilities at 3 years of age. Temperament was assessed with the Early Childhood Behavior Questionnaire (ECBQ) and ToM by assessing children's understanding of divergent desires and beliefs, and of knowledge access. Our results are in line with a social-emotional reactivity perspective postulating more sophisticated ToM abilities for children with less reactive more observant temperament. Children with shy temperament at 18 months and at 3 years were better in reasoning about others' mental states at age 3. Language, siblings and parental education had no effect on ToM. Findings indicate that temperament is related to ToM earlier in development than previously found, and that this relation is thus not unique to false-belief understanding.

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1. Introduction

The ability to attribute mental states such as beliefs, intentions, and desires to oneself and other people and to understand that actions are causally related to these mental states is commonly defined as Theory of Mind (ToM). Fueled by the classical work by Premack and Woodruff (1978), ToM development has become a widely researched topic in developmental psychology (see Sodian & Thoermer, 2006, for a review). Between 3 and 5 years of age, children develop an explicit understanding of the causal relation between mental states and actions. Around the age of 4 years, they understand that a belief about a state of affairs might be true or false and might therefore lead to a successful or faulty action (Wimmer & Perner, 1983).

In the classic false-belief task, children need to understand that another person's mental representation is different from their own, and to additionally take this knowledge into account when predicting or explaining her behavior. Well before children pass this false-belief task, they seem to regard the subjectivity and directedness of mental states while interpreting human behavior. For example, at the end of the first year of life, infants understand gaze and pointing gestures as goal-directed and they are able to share attention with another person in joint play (Tomasello, 1995) and they differentiate between their own and another person's opposite desire by 18 months (Repacholi & Gopnik, 1997). By 3 years of age, children refer to desires and true belief in predicting another person's action and begin to understand that visual access leads to knowing about the content of a box (e.g., Wellman & Liu, 2004).

Various factors have been supposed to influence social-cognitive development such as language development (e.g., Milligan, Astington, & Dack, 2007), executive control (e.g., Perner & Lang, 1999), family background (e.g., Cutting & Dunn, 1999), and recently also child temperament (Wellman, Lane, LaBounty, & Olson, 2011). The relation between children's language abilities and their ToM understanding is well investigated. A meta-analysis by Milligan and colleagues (Milligan et al., 2007), including 104 studies with English-speaking children below age 7, showed that both language ability in general as

* Corresponding author. Tel.: +49 6813023874.
E-mail address: d.mink@mx.uni-saarland.de (D. Mink).

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well as specific types of language ability (syntax, semantics, receptive vocabulary, memory for complements) were related to false-belief understanding, with the lowest effect size for receptive vocabulary measures. Also for German speaking children, language skills are a significant predictor of ToM development (Lockl, Schwarz, & Schneider, 2004).

Among family background characteristics, findings on the influence of siblings are controversial. A number of studies reported evidence for a positive influence of siblings on children's ToM development (Jenkins & Astington, 1996; McAlister & Peterson, 2006, 2007; Perner, Ruffman, & Leekam, 1994). In some studies, this positive influence on ToM development was found only for older siblings but not for younger ones (Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge, 2008; Ruffman, Perner, Naito, Parkin, & Clements, 1998), or only for siblings that were between 12 months and 13 years of age that is, with whom the child may engage in sibling-based play (Cassidy, Fineberg, Brown, & Perkins, 2005; Peterson, 2000). Finally, several studies did not find any sibling effect at all (Carlson & Moses, 2001; Cole & Mitchell, 2000; Cutting & Dunn, 1999; Peterson & Slaughter, 2003). Also controversial are the findings on the influence of parental education. Whereas some studies reported a strong relation between maternal education level and children's ToM development (Cutting & Dunn, 1999; Pears & Moses, 2003), others did not find such an effect (Ruffman, Perner, & Parkin, 1999). The same controversy is true for an influence of paternal education level (Cutting & Dunn, 1999; Dunn & Brown, 1994).

It is known that children's social experiences and interactions are influenced by their temperament (Rothbart & Bates, 1998). Moreover, social interactions contribute to and shape ToM understanding (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991). Therefore, it seems reasonable to assume that ToM development is influenced by children's temperament (Wellman et al., 2011). Temperament is commonly defined as personality traits that emerge early in ontogeny, show stability throughout childhood into adulthood, and have a substantial genetic component (Buss & Plomin, 1984; see Henderson & Wachs, 2007, for a review). There is evidence for stability in temperament already from infancy on (Komsi et al., 2006; Mink, Henning, & Aschersleben, 2013). According to Rothbart (1986), temperament is defined "as constitutionally based individual differences in reactivity and self-regulation" (p. 356; Rothbart & Derryberry, 1981). Reactivity refers to differences in infant's emotional, motor and attentional reactions in terms of, for example, threshold and intensity, whereas self-regulation refers to behavioral processes such as attention or approach and withdrawal that regulate this arousability of responses.

Compared to the vast amount of research on influencing factors on ToM development, relatively few studies have assessed the impact of temperament (Banerjee & Henderson, 2001; Carlson & Moses, 2001; Lane et al., 2013; Walker, 2005; Wellman et al., 2011). Carlson and Moses (2001) found a positive relation between inhibitory control and ToM performance in preschoolers. Banerjee and Henderson (2001) found a negative relation between school children's social anxiety and social-cognition tasks, particularly when it was paired with shy-negative affect. In a study with 5-year-olds, Walker (2005) obtained positive relations between false-belief understanding and aggressiveness as well as negative relations between false-belief understanding and shyness, but only in boys.

Whereas these earlier studies do suggest some influence of child temperament, they provide little consent with regard to what specific temperamental characteristics might enhance ToM development. Recent research suggests a developmental link between childhood temperament and ToM abilities that is specific to a less reactive more observant temperament (Lane et al., 2013; Wellman et al., 2011). Wellman and colleagues (Lane et al., 2013; Wellman et al., 2011) refer in their work to the emotional reactivity hypothesis (Hare, 2007) to explain how child temperament might influence ToM development. This hypothesis originally accounts for social-cognitive capacities in dogs. It holds that dogs that were selected for domestication due to their nonaggressive and non-fearful temperament regarding humans, developed human-like social-communicative skills during domestication in convergent evolution with humans, i.e., level of emotional reactivity has modulated social-cognitive performance. In cooperative-communicative situations, dogs show capacities similar to early social-cognitive capacities of children, whereas wild canines and even chimpanzees perform poorly in such situations (Hare & Tomasello, 2005; Povinelli & Eddy, 1996). Further evidence supporting the emotional reactivity hypothesis derives from findings showing that even bonobos and chimpanzees, the closest relatives to humans, differ in their social-cognitive abilities (Hare, Melis, Woods, Hastings, & Wrangham, 2007; Herrmann, Hare, Call, & Tomasello, 2010; Okamoto-Barth, Call, & Tomasello, 2007). Like dogs, bonobos outperform chimpanzees in social-cognitive tasks. These two species also differ from each other in temperament with bonobos being less aggressive and shyer than chimpanzees (Hare et al., 2007; Herrmann et al., 2010). Taking up this proposal by Hare and Tomasello (2005) that the initial difference in phylogeny might have regarded temperament, Wellman and colleagues (2011) assumed that also in child development an initial difference in temperament may lead to differences in interactive behavior and social experiences, which in turn may foster or interfere with the development of mental understanding. Supporting evidence is provided by their longitudinal study showing that 3 years old children who were rated by their parents as shy, nonaggressive and perceptually sensitive, showed more sophisticated ToM abilities 2 years later. The authors argued that this "less reactive more observant temperament" facilitates social participation and social information processing. Similarly, Lane and colleagues (2013) found relations between less aggressive temperament and false-belief understanding both in Chinese and US American preschoolers. In addition, they measured children's hypothalamic-pituitary-adrenocortical HPA-axis reactivity via salivary cortisol and reported that children with moderately high reactivity, which is related to social engagement and attentiveness (Blair, Peters, & Granger, 2004), exhibited more advanced ToM understanding.

As the relationship between temperament and ToM development has only been investigated in preschoolers or older children, the general aim of our study was to extend this line of research by longitudinally investigating the impact of early temperamental characteristics on ToM development. Specifically, we wanted to assess whether individual differences in

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